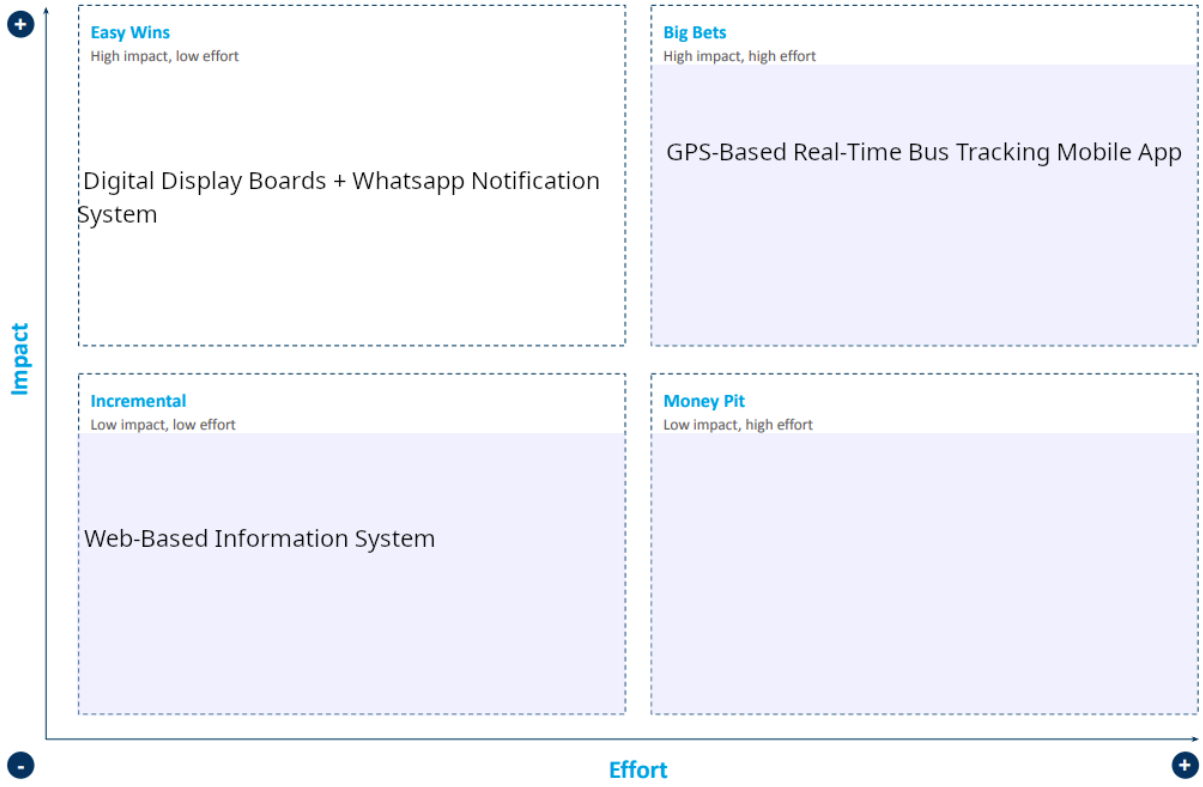
Team:
Rubban Iftikhar Ahmed (22I-1532)
Talha Aamir (22I-2502)
Sultan Shah (22i-0637)
Muhammad Mudassir (22i-1921)

Submitted To:
Ma’am Sadia Nauman

TBW Project Phase 1

National University of Computer and Emerging Sciences Islamabad, Pakistan



Impact-Effort Matrix Analysis

Solution 1: GPS-Based Real-Time Bus Tracking Mobile App
Quadrant: Big Bets (High Impact, High Effort)

Impact Rating: HIGH

- Survey data shows 80% of students prioritize real-time bus location (40%) and expected arrival time (40%) as their top desired features.
- Literature review demonstrates that GPS-based systems increase efficiency and user satisfaction in university settings. [1][2][3]

- Addresses all four critical issues from interviews: constantly changing buses/drivers (36.4%), inconsistent timings (27.3%), difficulty identifying buses (27.3%), and boarding confusion (9.1%).
- Reduces wait time uncertainty for 70% of students currently waiting 15-30 minutes.

Effort Rating: HIGH

- Requires GPS hardware installation on all buses (estimated 15-20 buses at PKR 30,000-40,000 per unit = PKR 450,000-800,000).
- Mobile app development for both iOS and Android platforms (PKR 500,000-800,000).
- Backend server infrastructure, API development, and database management (PKR 300,000-400,000).
- Annual maintenance, server hosting, and technical support costs (PKR 200,000+ yearly).
- Total estimated cost: PKR 1.5-2 million for initial setup + ongoing annual costs.
- Implementation timeline: 6-8 months
- Requires hiring external developers or dedicated IT team.
- While management has sufficient tech literacy for oversight, implementation demands specialized technical expertise.

Equity Note: Provides comprehensive real-time information benefiting all students equally, particularly those from distant areas who face greater commute uncertainty. Since all students own smartphones, there are no technology access barriers. However, high costs may delay implementation, temporarily maintaining current inequities in transportation information access.

Solution 2: Digital Display Boards (Gate 4 & Cafeteria) + WhatsApp Notification Channel

Quadrant: Quick Wins (High Impact, Low Effort)

Impact Rating: HIGH

- Directly addresses communication gap: 60% of students are rarely or never informed about schedule changes.
- Targets existing student behavior: 40% already check Gate 4 board, 20% use WhatsApp channels.

- Reduces stress for 70% of students experiencing frequent anxiety during wait times.
- Interview data confirms students want immediate, accessible information about bus status.
- Provides both passive (digital displays) and active (WhatsApp) information channels.

Effort Rating: LOW

- Digital LED displays: 2 screens at Gate 4 and cafeteria bus service desk (PKR 80,000-100,000 each, that sums up to PKR 160,000-200,000).
- Simple content management dashboard for transport staff (PKR 50,000-80,000 for basic software).
- WhatsApp Business API integration: Free or minimal cost (PKR 10,000-20,000 for setup).
- Installation and setup: PKR 30,000-50,000
- Total estimated cost: PKR 250,000-350,000 (one-time investment).
- Minimal ongoing costs: electricity and occasional maintenance (PKR 20,000-30,000 annually).
- Implementation timeline: 3-4 weeks
- Management can easily operate with existing technical competence; transport staff need only basic training.

Equity Note: Ensures universal, immediate access to transportation information for all students. Since all students own smartphones, the WhatsApp channel reaches 100% of the student body. Digital displays provide redundant, always-visible information at high-traffic locations, ensuring students don't miss updates even without checking their phones. Benefits students from distant areas who need reliable timing information most.

Solution 3: Web-Based Information System

Quadrant: Fill-Ins (Low Impact, Low Effort)

Impact Rating: LOW-MODERATE

- Provides static schedule information and route details accessible via any browser.
- Doesn't address real-time uncertainty about bus arrivals or sudden changes.
- Survey shows students want real-time location/arrival times, which a basic web system cannot provide without GPS integration.

- Still requires students to actively check websites; doesn't solve immediate information gaps.
- Doesn't address core problems: constantly changing buses/drivers, inconsistent timings.
- May reduce some stress by providing centralized schedule reference, but limited practical impact.

Effort Rating: LOW

- Simple responsive website development (PKR 50,000-80,000)
- Can be integrated into existing student portal or hosted separately
- Domain and hosting costs: PKR 10,000-15,000 annually
- Total estimated cost: PKR 60,000-95,000 (one-time) + minimal annual hosting
- Minimal maintenance required - static content updates by administrative staff
- Implementation timeline: 2-3 weeks
- Easily manageable with basic tech literacy from administrative staff

Equity Note: Accessible to all students since smartphone ownership is universal, allowing access anytime via mobile browsers or computer labs. However, provides limited equity improvement as it doesn't solve the real-time information gap that disproportionately affects students from distant areas who face longer commute uncertainties and less social network access to informal updates.

Justification

Recommended Solution: Digital Display Boards + WhatsApp Notification Channel (Quick Win)

This solution optimally balances high impact with manageable effort while maximizing cost-effectiveness and equity alignment. Survey data reveals 60% of students are rarely or never informed about schedule changes, and 70% experience frequent stress during 15-30 minute waits. Digital displays at Gate 4 and the cafeteria bus service desk provide immediate visibility at locations where 40% of students already seek information, while WhatsApp notifications reach 100% of students.

The critical advantage is cost-efficiency: at PKR 250,000-350,000, this solution costs approximately one-sixth of the GPS mobile app (PKR 1.5-2 million) while delivering comparable communication benefits within 3-4 weeks versus 6-8 months. Management's existing tech literacy suffices for operation, unlike the Big Bet requiring specialized developers.

This solution aligns with PIT values of trust and fairness by providing transparent, standardized information. Students won't need to learn new platforms or change their behavior—it integrates directly into their existing routines of checking the Gate 4 board and using WhatsApp, ensuring smooth adoption and immediate usability.

PROPOSAL FOR ENHANCED CAMPUS TRANSPORTATION COMMUNICATION SYSTEM

To: FAST NUCES Transport Management Authority
From: Rubban Iftikhar
Date: November 15, 2025
Subject: Digital Display Boards and WhatsApp Notification Channel Implementation

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Executive Summary

Current campus transportation services face critical communication failures, with 60% of students rarely or never informed about schedule changes and 70% experiencing frequent stress during 15-30 minute wait periods. This proposal recommends implementing Digital Display Boards at Gate 4 and the Cafeteria Bus Service Desk combined with a WhatsApp Notification Channel. This solution will provide immediate schedule updates to 100% of students at a cost of PKR 250,000-350,000 with a 3-4 week implementation timeline. The system will reduce student anxiety, improve operational efficiency, ensure equitable information access, and align with PIT's values of trust, fairness, and well-being.

INTRODUCTION

Purpose Statement

This proposal seeks approval and funding to implement Digital Display Boards and a WhatsApp Notification Channel for campus transportation services. This communication

system will address critical information gaps causing significant student stress, operational inefficiencies, and inequitable access to transportation information.

Needs Analysis

Increased Communication Failures

Survey data (n=100) reveals that 60% of students are rarely or never informed about bus schedule changes. This communication breakdown creates uncertainty and undermines trust in transportation services.

Student Stress and Time Loss

Seventy percent of students wait 15-30 minutes without knowing when buses will arrive, causing frequent anxiety and stress[4][5]. Interview data identifies four critical pain points: constantly changing buses/drivers (36.4%), inconsistent timings (27.3%), difficulty identifying buses (27.3%), and boarding confusion (9.1%).

Inequitable Access to Information

Students from distant areas face greater commute uncertainty but lack access to informal information networks. The current system disproportionately disadvantages these students, violating principles of fairness and equity.

Unmet Student Priorities

Eighty percent of students prioritize real-time information—specifically bus location (40%) and expected arrival times (40%). Current infrastructure fails to deliver this essential information, directly conflicting with demonstrated student needs.

DISCUSSION

Solution Analysis

Three solutions were evaluated using an Impact-Effort Matrix:

Solution 1: GPS-Based Mobile App (Big Bet) provides comprehensive tracking but requires PKR 1.5-2 million and 6-8 months implementation. High costs and extended timeline delay equity improvements.

Solution 2: Digital Display Boards + WhatsApp Channel (Quick Win) delivers immediate communication benefits at PKR 250,000-350,000 with 3-4 week implementation. This solution optimally balances impact with feasibility.

Solution 3: Web-Based System (Fill-In) costs only PKR 60,000-95,000 but provides static information unable to address real-time needs, offering limited practical impact.

Recommended Solution: Digital Display Boards + WhatsApp Notification Channel

This Quick Win solution directly addresses the 60% communication gap while leveraging existing student behavior: 40% already check Gate 4 board and 20% use WhatsApp channels[13][14]. The dual-channel approach ensures comprehensive coverage through passive displays and active notifications.

Cost-Benefit Analysis

Component	Cost (PKR)
2 LED Digital Displays	160,000-200,000
Content Management Dashboard	50,000-80,000
WhatsApp Business API Setup	10,000-20,000
Installation & Configuration	30,000-50,000
Total Initial Investment	250,000-350,000
Annual Maintenance	20,000-30,000

This represents one-sixth the cost of GPS alternatives while delivering comparable communication benefits.

Alignment with PIT Values

Trust: Transparent, consistent communication rebuilds student confidence in transportation reliability[6][8].

Fairness: Universal access ensures all students—regardless of social networks or residential location—receive equal information.

Sustainability: Low ongoing costs (PKR 20,000-30,000 annually) ensure long-term financial viability with minimal environmental impact[7][10].

Well-being: Reducing anxiety for 70% of students directly supports mental health and allows better time management.

Implementation Requirements

Personnel: Existing staff fulfill all roles with basic training—no additional hiring required. Transportation staff will manage daily updates (2-3 hours weekly), while IT provides minimal technical support (5 hours monthly)[16][17].

Timeline: Four-week implementation schedule:

- Week 1: Vendor selection and procurement
- Week 2: Installation at Gate 4 and Cafeteria
- Week 3: Staff training and system testing
- Week 4: Full launch with campus-wide communication

Equity Considerations

Universal smartphone ownership (100% of students) eliminates technology barriers. WhatsApp notifications reach all students immediately, while digital displays provide redundant information at high-traffic locations[11][12][15]. Students from distant areas—who face greatest uncertainty—will particularly benefit from reliable timing information without requiring behavior changes or learning new platforms.

Gantt chart

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Task Name**	**Start Day**	**Duration**	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
2	WEEK 1: PLANNING & PROCUREMENT																														
3	Vendor Selection & Contract Finalization	1	2	■	■																										
4	Digital Display Procurement & Shipping	3	3			■	■	■																							
5	Software Licensing & WhatsApp Setup	5	3					■	■	■																					
6	MILESTONE: Equipment Procured	7	1							■																					
7	WEEK 2: INSTALLATION & CONFIGURATION																														
8	Site Preparation (Electrical, Mounting)	8	2								■	■																			
9	Display Installation (Gate 4 & Cafeteria)	10	2										■	■																	
10	Software Installation & Network Config	12	2												■	■															
11	WhatsApp Business API Integration	14	1														■														
12	MILESTONE: Installation Complete	14	1														■														
13	WEEK 3: TESTING & TRAINING																														
14	System Testing & Content Upload	15	2															■	■												
15	Staff Training Sessions	17	1																	■											
16	Pilot Testing with Transport Department	18	2																		■	■									
17	User Acceptance Testing & Adjustments	20	2																				■	■							
18	MILESTONE: System Tested & Staff Trai	21	1																					■							
19	WEEK 4: LAUNCH & MONITORING																														
20	Soft Launch with Limited Announcements	22	2																						■	■					
21	Full Launch & Campus-Wide Communica	24	2																								■	■			
22	Monitoring & Issue Resolution	26	2																										■	■	
23	Post-Launch Review & Optimization	28	1																												■
24	MILESTONE: Full Operational Launch	28	1																												■

CONCLUSION AND RECOMMENDATIONS

Campus transportation communication deficiencies create unnecessary stress and inequity for students. The recommended Digital Display Boards and WhatsApp Notification Channel solution addresses these critical gaps through an evidence-based, cost-effective approach delivering immediate benefits at PKR 250,000-350,000.

Key Performance Indicators will measure success:

1. **Student Satisfaction:** 80% report adequate schedule change notification (baseline: 40%)
2. **Complaint Reduction:** 50% decrease in transportation-related complaints within 6 months
3. **Equitable Access:** 90%+ of students across all demographics receive timely updates

Recommended Action: Approve budget allocation for immediate implementation beginning Week 1 of next month. This timeline ensures the system becomes operational within the current semester, providing prompt relief to students while demonstrating institutional commitment to their well-being and success.

The evidence strongly supports this Quick Win investment that will improve student satisfaction, operational efficiency, and institutional equity while positioning PIT for future transportation enhancements.

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